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How to Preserve the Sight.

TO preserve our sight we must learn what certain feelings about the eye mean, and why it is so often subject to fatigue and pain.

We cannot afford to give up the entire use of our eyes because they ache, nor can we afford to disregard these symptoms, lest we run the risk of impairing or losing our sight. We want to preserve our sight to the last and to avoid disease.

The number of blind persons in every civilized community is exceedingly large. Of the persons who are commonly said to have been blind from birth, probably at least ninety-nine out of every hundred brought with them into the world eyes as good and as useful as those of their neighbours. The causes of infantile blindness are more frequently to be found in carelessness and ignorance than in all possible injuries and diseases put together ; and the carelessness and the ignorance are displayed most frequently in the neglect of proper precautions about light, cleanliness, and temperature.

A vast number of cases of defective sight can be traced to education—from the great strain on the almost unformed lenses of the eyes of children.

Too much study, too continuous use of the eyes on near objects, too little out-door life and exercise of the eyes in distant vision, these are possibly sufficient to cause near sight, without hereditary influence. Near sight in children is usually noticed at about the age of six or seven if the tendency is inherited ; and from this age up to that of fifteen or sixteen if acquired.

It must be remembered that in youth the tissues of the eye are soft, yielding, and undeveloped ; that it is a growing organ, easily moulded ; that its future, like other parts of the body, is to be very much what it is made, by training, use, and abuse.

Now, a studious boy or girl of ten or fifteen years, besides the five or six hours' work in school, studies also more or less at home, while the leisure hours are spent over novels or books of travel. In short, the eyes are not only used nearly continuously in regarding near objects, but their use for distance is almost wholly neglected. It is not surprising that, under such training, an organ should lose some portion of its functional power.

There is no doubt that deficient and improperly admitted light in school-rooms is one cause of the rapid progress of this optical defect. To sit facing a light during study, for instance, is extremely injurious to the best eyes. On looking up,

the eye becomes saturated with light, and then, on turning to the printed page, an extra accommodation effort must be made to overcome the dazzling and clear up the vision. The light should enter from above, and at the side, so as to strike the page of the book, and *not* the eyes ; and it should be, if possible, a direct rather than a reflected light.

A deficient illumination is injurious because it requires the book to be brought near the eye, and this tends to pressure on the eye-ball from the muscles of convergence, and the other external muscles that control its movements.

This muscular pressure on the yielding eye-ball promotes indirectly a bulging of the eye at the back, and so contributes to the progress of near sight, or Myopia. School statistics, made some years ago, and verified again and again since, have shown that it progresses with the age of the pupil and the increased demand upon the eyes. That is, in the elementary school there are fewer, and in the higher schools, more, near sighted ; and the grade of the defect is also more severe as we reach the high class school and college.

The same strain on the eyes of adults may cause a disorder of the muscles of accommodation and convergence. In health, these two muscles work together in perfect harmony. If either one become affected, this harmony is disturbed, and weak or painful sight may follow ; but, as a

rule, the cause of weak sight is an over-worked, fatigued, sensitive condition of these muscles.

Vision has often been enfeebled or destroyed by exposure to a dazzling light. Every one knows the discomfort which is experienced from a sudden increase of light ; such discomfort should be regarded as a warning of the dangerous character of the circumstances which call it forth. Temporary or permanent loss of vision has been occasionally produced by the reflection of the solar rays into an eye from a mirror or other like surface ; and many people have suffered by partial and total loss of sight through their folly in looking at the sun, and the most prompt treatment has sometimes barely sufficed to prevent complete blindness.

The eyes may suffer in adult age from a variety of causes besides those already mentioned, such as excessive application ; unclean or impure air ; exposure to cold ; mechanical or chemical injury ; from mental conditions ; and from many so-called pleasures ; un-natural conditions of the general system, which either occasion determination of blood to the eyes and to the head, or which depend upon abnormal states of the blood, by which the strength of the whole body, and with it that of the eyes, is reduced ; and finally, from the want or misuse of spectacles. The general principles which should be borne in mind, in order that the evils hence arising may be avoided, are of importance to every one who wishes to

preserve his eyes in a state of health and efficiency.

The Construction of the Eye.

THE coats of the Eye are arranged similarly to the tubes of a telescope, being fitted one within another suitably for the transmission of the rays of light; and the optic nerve, expanded on the back of the eye, forms the internal coat of that part called the retina, and on this the images of all objects presented to the eye are received and transmitted to the brain and mind.

In order that the image of an object on the retina shall be clear and distinct, it is necessary that the rays of light passing into the eye through the pupil should be properly focussed.

Vision will be clearest and easiest if the rays of light are brought to a point exactly as they reach the retina.

If they are focussed just before, or if they reach the retina before being focussed, the sight will be more or less blurred.

How we See, or the Healthy Eye.

THE vision of the naturel healthy oye ranges from infinity to a so-called *near point*, which gradually becomes more remote from the cornea as life advances, but which should not be farther away than eight inches.

A pair of such eyes possess clear vision of all objects over the specified range of distance, that is, from eight inches to the horizon or the fixed stars; and they can continue the act of seeing at any point over the whole of this range for any reasonable time without interruption.

There are three kinds of defective sight owing their origin to the faulty formation of the eye-ball—

1st.—Myopia, or Near Sight, in which the length of the eye-ball from front to back is in excess.

2nd.—Hypermetropia, or Far Sight, in which the length of the eye-ball from front to back is less than the standard for a normal eye; and

3rd.—Astigmatism, or Peculiar Sight, which is due to a want of symmetry of the cornea, which, instead of being spherical in its outline, is somewhat differently curved in two opposite directions.

Myopia, or Near Sight.

THE vision of the myopic eye is conditioned by space, in not being able to see clearly any objects which lie *beyond* a definite distance.

Hence we see short-sighted people hold objects to be examined *close* to the eyes.

When a person is able to read small print *easily* and fluently in the hand, and has not the normal standard for *distant* vision, we may at once infer that he is a subject for Myopia.

When Myopia is once established, and unless its influence is speedily counteracted, it provides for its own increase by the effect of convergence effort, and it may attain a considerable degree before even its very existence is discovered by parents of only ordinary observation.

The best thing that be done in the treatment of children so suffering is at once to stop their reading and all use of their eyes for near objects as much as possible, and make them use their eyes for distance. Encourage them in out door exercises, and after a time, when the improvement which is sure to follow this treatment ceases, and the patient's health is good, a proper pair of glasses can be worn and the studies gradually resumed.

Great care will, however, have to be taken that children do not become too studious. Out-door exercise must still be taken, and the eyes well-used in looking at distant objects.

The use of glasses for reading, "not that the patient may see better, but that he may see *farther off*," is absolutely necessary, and should always be enjoined during school life, or periods of close study, as the only means of preventing an increase of the Myopia or near-sightedness.

It is the more necessary to render this clearly understood, because patients are naturally most disposed to prize and to use glasses for doing what can not be accomplished without them, that is, for seeing distant objects.

They are often unwilling to use them for near work alleging, and for a time with perfect truth, that they can see better and more comfortably without them. It is not uncommon, indeed, for short-sighted people to say, when asked if they have used glasses for reading, to assume a tone almost of self-righteousness in their denial of the imputation. They say, "Oh, no, I have never done that!" and are often greatly exercised in their minds when the urgent necessity for a total change of their habits in this respect is explained to them.

If we consider for a moment what must be the state of a person who has grown up to manhood or womanhood with an uncorrected Myopia of only a slight nature, we shall not fail to perceive the great importance of its correction.

A person with healthy sight may produce the condition artificially by placing magnifying spectacles before the eyes. The Artificial Myopia, or near-sight, thus produced, would be deprived of

half its inconvenience by the previously-acquired knowledge of the exact forms and characters of numerous objects, which would be only dimly seen ; but the subject of it would find, for example, that instead of being able to tell the hour by an ordinary drawing-room clock from any part of the room, he would have to approach within three or four feet of the dial in order to perceive dim indications of the hands. He would lose all the play of expression on the faces of persons with whom he was engaged in conversation.

A curious commentary on the state of life passed by Myopia persons is daily seen by me, by the pleasureable expressions of my patients, when these defects of vision have been properly remedied, by the use of proper Spectacles.

Hypermetropia, or Far Sight.

THE presence of Hypermetropia is generally made known, even in early life, by the fatigue, pain, and speedy dimness of vision which attend the employment of the eyes over any matters requiring close application.

The patient will read fairly well for a time, but after a period, varying with the degree of

the defect and with the strength of the muscular system, there comes to be a consciousness of effort in the act of seeing. The eyes feel strained, and the letters become somewhat blurred, and are only restored to clearness by distinct and often strenuous effort. There is an instinctive desire to rest the eyes, close them firmly for a moment or two, and often to compress the closed eyes with the hand. After doing this a fresh start is made, only to terminate in another compulsory stoppage after a shorter period than the first. In some instances, a habit is acquired of unduly approximating the book or other object of vision, in so much that the condition has actually been mistaken for the opposite one of Myopia, and the wrong lenses have been prescribed for its relief.

If the subject is compelled to work continuously, as by the demands of some occupation which cannot be laid aside, the eyes are apt to become red, blood-shot and irritable, and to suffer from obstinate forms of inflammation or irritation. The symptoms not unfrequently undergo sudden increase, as an effect of the general debility by some form of enfeebling illness.

It is essential to the complete relief of Hypermetropia that spectacles should be worn always, but it will often happen that the patient cannot bear full correction of his defect at first.

It is therefore often necessary to correct only a portion of the defect in the first instance, and wait for the return of some of the old symptoms, when the lenses first used may be strengthened

either to the extent of full correction, or by another step towards it ; the full power sometimes not being used except by three gradations.

Hypermetropia is sometimes the cause of weak sight in children.

It is also the usual cause of squint or cross eye, and this can often be cured in the beginning by the use of proper spectacles ; but if it is of long standing it can only be cured by a surgical operation.

Astigmatism, or Peculiar Sight.

ASTIGMATISM has been already described as due to a want of symmetry of the eye-ball.

A very small amount of Astigmatism is probably the natural condition of the human eye, and the defect must exist in an unusual degree in order to be disturbing to vision.

This visional defect may be recognized by a conspicuous difference in the distinctness with which lines drawn in different directions are seen from the same point of view and with the same adjustment of the eye. This defect is of course a great hindrance to clear and easy vision in reading, as letters are made up of lines running in different directions.

Asthenopia, or Weak Sight.

IN the Asthenopia or weak-sighted eye there may be limitations of vision within given distances, but the limitation chiefly complained of is one of *time*.

The patient can see, if not perfectly, yet sufficiently well for many purposes, *for a given period only*, and when this period is over past, the sight becomes blurred, or the eyes become painful, use of them in either case becoming difficult or impossible.

If the symptoms of pain, confusion of vision, dread of light and of all use of the eyes, continue, and no measures are taken to ameliorate or remove them, there is danger of the eyes not only becoming nearly useless, but that they may finally get so sensitive and irritable that ordinary daylight cannot be borne without pain and discomfort. When weak sight has been allowed to progress for years, it sometimes becomes so severe that one finds a darkened room the only really comfortable place, dark-coloured glasses even not affording a sufficient protection from the light.

Severe cases of weak sight are tedious and difficult to cure, and particularly so if of long standing, but recent cases are curable.

When prescribing spectacles for Asthenopia or great severity or long standing, we shall often find that the use of the eyes is as painful or difficult as before. For a time this will be so in

many cases ; and it is well to warn patients that their glasses will call upon the eyes to work under new conditions, which, although better than those which they supersede, may yet be irksome so long as they are new.

They must not, therefore, expect immediate relief as a rule.

We often have to deal with the effect of that most pernicious of all recommendations, the recommendation to "rest the eyes," and consequently, with organs which have been brought by disuse into a state of debility and excitability. Such conditions can only be relieved by careful strengthening of the weakened muscles. This is best accomplished by selecting a book of good type, and to read regularly with the prescribed glasses three times a day. The patient must determine by trial the number of minutes he can read without discomfort. The first reading must not be until half an hour after breakfast, the second about noon, and the third finished before dusk. The periods of reading must be regularly increased from day to day. In cases where discomfort occurs in less than five minutes, the increase should not be more than half a minute per day until ten minutes are reached. In other cases, the patient may increase one minute until he can read thirty minutes three times a day without pain. If this can only be done with pain the patient must persist notwithstanding.

Should the pain continue from one period to the next, it is evident that he has gone beyond

the maximum of his ability, and he should fall back to a period at which he can read without discomfort, and proceed as before, gradually lengthening the periods of exercise.

The patient who finds that he can read for ten minutes without distress is very likely to go on for twenty minutes; but to do this is to invite relapse. It is better to submit quietly to a period of self-restraint, than to lose time by fruitless endeavours to hasten a process which depends entirely upon the gradual strengthening of the muscles.

In many obstinate cases of Asthenopia, we should find some derangement of the health. Under such circumstances the patient must not expect, by the employment of spectacles, to render unnecessary all the other resources of the healing art.

The condition of eyes may often be greatly improved by treatment specially directed to them; but complete restoration is hardly to be hoped for, except in conjunction with a corresponding degree of improvement in the general health, and to this end the patient must call to his aid the advice of the general physician.

Presbyopia, or Old Sight.

THE vision of the old-sighted eye is also conditioned by space, in not being able to see clearly any objects which lie *within* a definite distance.

The changes which result in Presbyopia, or old sight, may be said to commence from the age of twenty years, when the near point begins to recede, and at about the age of forty or forty-five, and sometimes perhaps rather earlier in life, we notice a desire for a good strong light in reading or threading a needle, and a disposition to push fine reading or sewing farther away from the eyes. Then follow more or less fatigue and confusion of sight in reading and sewing, in the evening especially, if tired, and it is found comfortable to favour the eyes by frequent rest and change of occupation. Very soon a like difficulty in reading fine print is noticed in the day time.

Hence we see old persons hold objects to be examined far off from the eyes.

This is due to a partial loss of the accommodative power of the eyes.

Hence, in looking at a distance, the accommodative or adjusting power not being required, the eye sees as well, or nearly as well, as ever ; but in near vision, the accommodative power being necessary, and not being available, vision is imperfect. The loss of the accommodative power is not from disease of the eye at all, but is chiefly

owing to the natural increase of the hardness of the lens and consequent loss of its elasticity.

It is surprising how frequently we find persons trying to postpone what they look upon as an evil day, and delay obtaining the help of properly-suiting spectacles until they have fruitlessly tried to do without them.

This is a great mistake ; nothing is gained by waiting, and much may be lost. We lose, in the first place, a great deal of amusement and instruction from the necessity of giving up our evening reading and neglecting fine work of all kinds. In the beginning, these interruptions in our ways of passing time are not so serious and frequent as to give much annoyance, but as old sight increases, they become of importance. In the second place, and of greater moment, is the risk we run of fatiguing and straining the eyes, and so causing weak sight.

Nothing is gained by postponement ; the eyes are not made stronger, and are likely to be made weaker.

At the present time there need be no fear that the adoption of glasses will be interpreted as a confession of old age. I have frequently to prescribe for young people lenses as strong as those usually worn by people of advanced age. Most men and women do the serious and best works of their lives after the age of forty, and some even after the age of sixty.

Cataract.

CATARACT, or opacity of the lens, is due to changes in the structure and composition of the lens fibres. These changes seldom occur throughout the whole lens at once, but commence first in some one part, such as the centre, whilst in certain forms of Partial Cataract the disease remains permanently confined to some well-circumscribed parts.

Cataract is manifested by a whiteness in the pupil, which is naturally of a clear black, and vision is more or less impaired, according to the greater or less opacity of the crystalline lens by which the rays of light are proportionately intercepted. Persons of all ages are subject to Cataract, but those of an advanced age are more so than at an earlier period of life.

Opacity and dimness of sight usually commence very slowly, and gradually increase in extent and degree till vision becomes materially obstructed and total blindness ultimately ensues. Usually, one eye becomes affected first, and afterwards the other, and it is very rare that both are affected at the same time.

The impairment of sight produced by Cataract presents several peculiarities. It is greater for distant than for near objects.

In the early stages of the disease the patient will turn his back to the light when trying to do his best in the way of seeing, and in time he comes to protect his eyes from the light as much

as possible, knitting the brows, bending the head, and even putting up the hand as a shade; vision is better in a dim light.

Persons suffering from Cataract, therefore, come into a room with a gait which is usually peculiar and often characteristic, and which widely differs from that of persons in whom, from any cause, there is impairment of light-perception. The former will shade the eye and bend down the head; the latter will have eyes widely open and head erect. Cataract can only be cured by operation.

It may be months or even years before the disease arrives at such a state as not to be assisted by the use of spectacles, and even after an operation has been performed, the use of Cataract lenses becomes indispensable.

Colour-Blindness.

COLOUR-BLINDNESS may be congenital or acquired. In the latter case, it denotes some disease of the optic nerve. It also occurs as a symptom in certain functional disorders.

Congenital Colour-blindness is not often identified unless specially looked for. According to recent and extended researches in various countries, a proportion, varying from about 3 to 5 cent, of the males, are colour-blind in various degrees.

There is a reason to believe that it is commoner in the lower classes than amongst those who are better educated. These facts show the importance of carefully testing all men whose employment renders good perception of colour indispensable, such as railway signalmen and sailors. * Colour-blindness is usually partial, that is, for only one colour, but is occasionally total. The commonest form is that in which green is confused with various shades of grey and red ; blindness for blue and yellow is very rare.

Congenital Colour-blindness is very often hereditary, but nothing further is known of its cause. It is scarcely ever seen in women. It always affects both eyes.

Night-Blindness.

NIGHT-BLINDNESS may be caused by temporary exhaustion of the retina from prolonged exposure to diffused bright light.

* NOTE.—Since writing the above, the Bengal Government have taken up the subject of Colour-Blindness, and have published rules for the examination of Masters, Mates, and Engineers of Foreign and Home trade ships, who apply at Calcutta for certificates of competency. It would be well if these rules were also applied to the examination of Railway Engine-Drivers and Guards.

The circumstances under which it comes on are such as imply not only great exposure to light, but lowered nutrition of the system. Possibly its actual cause may be some constant defect in diet, such as want of fresh meat or vegetables. Sleeping with the face exposed to bright moonlight is believed to help in its production. Thus it is commonest in sailors after a long voyage, with hardships in the tropics, and in soldiers after long marching under a bright sun. It may be caused by inhaling noxious vapours.

Snow-blindness appears to be essentially the same disease with the addition of considerable congestion, pain, and intolerance of light. These changes are thought to depend on the effect of the rarified atmosphere in which, in mountaineering cases, the exposure occurs. Night-blindness frequently attends scurvy in tropical climates. The sight might become similarly injured by prolonged work on minute objects in a bright light.

There are, however, certain other cases of night-blindness the cause of which are obscure, and on whose course no treatment has any influence. The disease generally progresses slowly to almost complete blindness. The sight is often better one day than another, but fails altogether by candle or gas-light, till at length the disease affects the eye by day light, and the sight becomes permanently impaired.

Muscae Volitantes, or Floating Speaks.

MUSÆ VOLITANTES appear to the patient under various forms, floating about in the field of vision. They are often very annoying, but do not interfere with the perfection of sight. They appear at times to consist of slender rings, which seem to ascend from the lower part of the field of vision and then to fall down again. In other cases, they take the form of pearly strings, which twist and twine about in all directions, or they may be seen as fine bands hovering about in the visual field.

They are most distinctly seen when the patient looks at some clear bright object, as, for instance, at the sky or a white wall; in a dim light they are probably not visible. After over working the eye, they are very apparent, and also if the digestive organs are out of order. Muscæ are by no means a symptom of any great consequence, and are often observed by persons whose eyes are perfectly healthy. Short-sighted persons are very apt to suffer from Muscæ in consequence of the increased circles of diffusion cast by the minute bodies on the retina.

It will often be found that cases of Muscæ depend on gastric derangement, or at any rate occur when the stomach or liver is out of order, and a little attention bestowed on those organs will do much towards removing the Muscæ. In

other cases, rest and a tonic plan of treatment are of service. Lastly, it should be remembered that Muscæ sometimes remain stationary for years, and then disappear of themselves. Tinted lenses often prove useful to patients suffering from Muscæ.

Having already noticed the more serious optical imperfections of the eye, and enabled our readers to discover what, if anything, is faulty in their vision, it remains now to be said that all eyes, including such as are considered perfect, are, optically considered, far from perfect.

Spectacles.

OF the many advantages Optical Science has conferred on us, we are certainly most indebted to Spectacles. The pleasure and advantage derived from their use are appreciated by all classes of society.

By their help the sight of the age is greatly assisted, and that of the weak strengthened.

The determination of the proper spectacles for any defect of the eyes is undoubtedly a matter of the greatest importance.

This importance is increased, on the one hand, by the number of patients requiring such assistance ; a number that, throughout the civilized

world, may be reckoned by millions ; on the other, by the actual injury inflicted by unsuitable glasses ; and lastly, by the customary sale of most spectacles by persons who have no adequate knowledge of the conditions of their utility.

Since the visional process is not an absolutely simple action, but is compounded of several acts which are originally independent, and which, through the unity of the sensorium, come secondarily to influence one another, it follows that, in defects of vision, the determination of the necessary spectacles can never be a perfectly simple procedure.

It requires a due consideration of all the ocular functions ; and the neglect of any one of them may produce a strain which will act injuriously and will impair the eyes ; while the proper spectacles adapted to correct the defect would be preservative and beneficial.

The injury produced by wearing improper spectacles is not always immediately perceived ; but when, after long use of them, the sight comes to be sensibly impaired, it is considered as the natural consequence of age--although the greater part of the evil be occasioned by using lenses carelessly adapted to the eye.

With the healthy eye, on looking at a distance, the rays of light that enter the eye are focussed on the retina without effort ; but in regarding near objects, as in reading or writing, there is an effort of the eye to focus the rays of light, other

wise they would reach the back of the eye without being brought to a point at all.

The reason of this is, that rays of light from small objects, as in letters for example, approach the eye not in parallel lines, but in lines that diverge as they pass into the eye. To converge such lines to a point on the retina requires more focussing power than if they entered the eye in parallel lines.

This focussing power is furnished by a muscle, and when it is brought into use the lens is made more convex or full, and thus a greater focal power is given to the eye.

If we look at distant objects, the muscle relaxes, because the use of the accommodative power is unnecessary; but always in reading, writing, sewing, and every kind of occupation requiring fixation of sight on near objects, this accommodative apparatus is brought into use.

Though involuntary, the accommodation or adjustment of the eyes for near objects is an effort. Hence the relief that comes from looking up and off from near work, so especially grateful to fatigued and sensitive eyes.

Another factor in the act of adjustment of the eyes for near objects is convergence. By this is meant the turning inward of the eyes so that both may be directed to the same object. The convergence of the eyes is also an effort, and is brought about by a muscle on the outside of each eye-ball attached to the white of the eye, on the side

towards the nose. In health, both these muscles work together in perfect harmony.

If the cornea, or the crystalline humour of the eye, or both, be too flat, the rays that pass through the pupil will not converge upon the retina, but behind it, and thus the sight of the object must, of course, be imperfect and indistinct. To remedy this evil, a *convex* lens of a proper focal distance must be placed before the eye, to refract the rays towards the centre ray, and so cause them to meet sooner than they did before, and thus form the proper image on the retina.

If, on the other hand, the cornea or crystalline, humour be too convex or protuberant, the rays passing through the pupil will meet in the vitreous portion of the eye before they reach the retina, and an equal indistinctness of vision will be produced. This is to be remedied by placing a *concave* lens before the eye, which, by diverging the rays, will prevent their meeting until they arrive back at the retina. The different distances at which different persons, or the same persons at different periods of life, can see distinctly, or the length of their sight, must depend on the elasticity of the lens and its accommodative power.

Lenses are usually constructed from various material, such as pebbles or glass. It must not be supposed that all those made from pebbles are equally good ; on the contrary, their only slight advantage of hardness is usually more than neutralized by their not having been cut from the